Characterization of Open Burning Emissions

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Introduction / Background:

- The Agency has recognized open and uncontrolled burning of waste and biomass as a potentially significant but poorly characterized source of air toxics, including chlorinated dioxins and furans, polycyclic aromatic hydrocarbons (PAHs), fine particulate matter (PM2.5), volatile and semi-volatile organic carbons (VOCs and SVOCs), and hexachlorbenzene (HCB). These pollutants can impact public health, reduce visibility, and control climate processes.
- Work at ORD/NRMRL is determining emission factors for the suspected largest sources of open/uncontrolled burns and including these data in national inventories and regional air quality model simulations.
- Efforts over the last five years have documented emissions from woodstoves, barrel burns of domestic waste, pressure treated lumber (CCA) fires, forest fires, and prairie fires as well as various agricultural practice fires such as sugar cane and wheat, rice, and grass stubble.
- Emissions have been characterized by a combination of field sampling and laboratory-based simulations.

Combustion Sources:
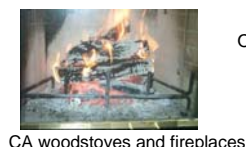
MN prairie grass fires

OR wheat and rice straw fields

CCA-treated wood

Illicit e-waste recycling, China

CA woodstoves and fireplaces

HI and FL sugarcane fields

FL scrub burns

Forest fires

Landfill fire, The Gambia

Residential waste backyard burning, USA and UK

Sampling and Data-Gathering Methods:

Fixed platform air samplers.

Mobile forest fire sampling

Satellite image data.

MODIS Thermal Anomalies Product [Giglio et al. 2003]
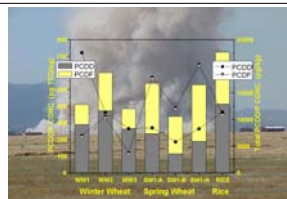
Biomass fire on burn platform

Ambient air sampler in facility.

Stack sampling.
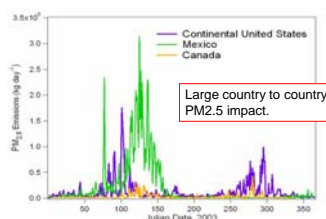
Laboratory open burn facility

Some Results

➢ *PCDD/F (dioxins) Emissions from Wheat, Rice Stubble.*

Relatively low emission factors from wheat and rice straw stubble.

➢ *PM2.5 Predictions from Agricultural Sources*

Large country to country PM2.5 impact.

Emissions of PM2.5 from fires located in agricultural areas. The fire emissions occur at different times of years depending on the location within the continent. The episodic impacts of agricultural fires on PM2.5 concentrations can be large.

➢ *PCDD/F (dioxins) from Forest Fire Simulations*
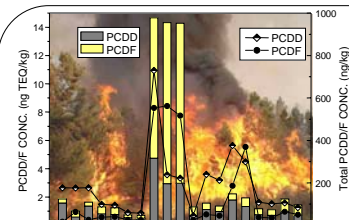
Large variation in emission factors depending on source of forest biomass (NC, OR).

Conclusions:

- Open burning sources (biomass and waste) can be relatively large sources of PCDD/F potentially accounting for the largest percentage of these pollutants.
- Some PCDD/F tests have shown high, albeit variable, emission factors. This variability may be a function of chloride concentration and/or combustion characteristics.
- A fire emissions model has been developed that estimates daily emissions of PM10, PM2.5, and trace gases from all fires identified by satellite. The model shows that PM2.5 fire emissions can make a very large local impact and can have large regional impacts.
- The emissions of PM2.5 from U.S. fires are significant: approximately 10-15% of the total U.S. national PM2.5 emissions.

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